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VEHICLE AIR BRAKING SYSTEMS

The present invention relates to vehicle air braking systems, and particularly to the removal of moisture from such systems.

A typical air braking system includes a compressor, an air dryer for compressor outlet air and a reservoir for pressurised air. The compressor output is directed via a non-return valve through the air dryer to the reservoir. The reservoir may comprises a purge volume and a service volume separated by a non return valve. Periodically dry air from the purge volume is directed back through the air dryer (which typically includes a bed of desiccant material) in order to purge the majority of moisture therefrom. Purging may be controlled by, for example a timer, and can occur after the compressor has been off load for a predetermined time.

It is important that moisture is periodically removed from the air dryer so as to prevent degradation of the desiccant bed, and corrosion of the air dryer and other components and conduits of the braking system. In periods of cold weather it is possible that moisture present in an air dryer overnight can freeze with the consequence that operation of the air dryer is impeded and/or the air dryer is damaged and/or the braking system rendered inoperable.

As described above, purging occurs after the compressor has been off load for a predetermined time. This presents a problems when purging the air dryer before a vehicle ceases to be used, for example when it is parked overnight. In bringing the vehicle to a standstill air is expended from the reservoir, and the resulting drop in reservoir pressure can bring the compressor on-load to replenish the reservoir. As a purge of the air dryer cannot be carried out while the compressor is on-load, the vehicle engine must be run until the compressor goes off-load before the air dryer can be purged. Consequently a vehicle driver must remain in the vehicle with the engine running until the reservoir is replenished. Such a procedure is both wasteful of the driver's time and vehicle fuel, and thus often the system is not purged at the end of the working day, as would be desirable.

According to the present invention there is provided a vehicle air braking system including an air compressor, an air dryer, an air dryer control valve having a vent to atmosphere, a reservoir adapted to contain a quantity f dry air for use in regenerating desiccant of the air dryer and means to exhaust the dry air through the desiccant and control valve to atmosphere, the system further including control means sensitive to the operating condition of the vehicle and operable to cause regeneration of the desiccant and purging of the control valve when the vehicle engine is stopped.

The control means of the present invention sense when operation of the vehicle ceases, for example when it is parked, and automatically regenerates the desiccant to remove moisture therein. This eliminates the need for the driver of the vehicle to keep the engine running and wait for the compressor to go off load. By regenerating the desiccant automatically on vehicle shutdown, the possibility that the desiccant may be damaged by the freezing of moisture therein is reduced. Moisture which may be present in venting ducts, control valve passageways or in the air dryer body is also expelled, which reduces the possibility of the subsequent operation of the venting system being hampered or prevented by ice.

A further advantage of the invention is that automatic regeneration at the end of the working day necessarily leaves the desiccant in a dry condition. In turn this can reduce the time to pump up the system on the following day since an intermediate regeneration might be avoided. Such an intermediate regeneration would interrupt charging if the air dryer remained in a relatively wet condition at the end of the previous working day, and become saturated part way through initial charging. Intermediate regeneration could be triggered by for example moisture sensing or the sensing of volume pumped since the previous regeneration.

In a preferred embodiment the control means are operable to open the control valve vent of the air braking system, and preferably to close the vent once regeneration has taken place. Closure of the vent isolates the control valve and desiccant from atmosphere and prevents the ingress of matter such as dust and insects, and further prevents degradation of the desiccant via moisture in the ambient atmosphere. The control means may be responsive to the state of the vehicle ignition system. The vent may open against a resilient bias and thus automatically return to the closed condition after regeneration. Such an arrangement

ensures that the braking system is closed against ingress of moisture through the vent valve whilst in a passive condition.

Preferably the control valve is switchable between an inlet position, where air received at an inlet thereof passes to the reservoir via the desiccant, and an exhaust position where air in the reservoir is permitted to flow through the desiccant and control valve vent to atmosphere. The control valve can thus be used for both periodic regeneration of the desiccant when the vehicle is in use and purging of the system at the end of the working day. In a preferred embodiment the control valve and vent are provided in a common housing of the air dryer. It will be appreciated that that such an arrangement eliminates the need for additional piping to be provided between control valve, vent and air dryer which reduces the size of the system and complexity. By positioning the control valve is intermediate a desiccant chamber of the air dryer and the vent, it is ensured that the control valve is purged of any moisture contained therein. In a preferred embodiment the reservoir surrounds the air dryer.

The invention also provides a method of regenerating an air dryer of a vehicle air braking system and purging a control valve of the air dryer at the end of the working day, the method comprising the steps of:

determining that the vehicle engine is stopped;
connecting a regeneration reservoir of dry air to the air dryer;
connecting the air dryer and control valve to atmosphere; and
backflushing the air dryer and control valve to remove moisture therefrom.

Such a method may be used in an existing air dryer installation by suitable control of system components.

An embodiment of the present invention will now be described with reference to the accompanying drawing (Figure 1) which shows cross sectional representation of combined reservoir and dryer assembly according to the present invention.

The assembly, generally designated 10, comprises an airtight container 12 having an inlet 14 and an outlet 16. The inlet 14 is closed by a control valve 18. The outlet 16 is closable

in use by a demand valve of the air braking system (not shown) within which the component is incorporated. The container 12 is provided with an internal partition 20 dividing the interior thereof into two chambers; a service chamber 22 and a purge chamber 24. A non-return valve 26 of the partition 20 permits one way fluid communication from the purge chamber 24 to the service chamber 22.

A desiccant compartment 28 is located downstream of the inlet 14 within the purge chamber 24. A passageway 30 having a non-return valve 32 is arranged between the desiccant compartment 28 and the purge chamber 24. The non-return valve 32 is arranged such that air can pass from the inlet 14 through the desiccant compartment 28 and into the purge chamber 24 but not in the reverse direction. The desiccant compartment 28 is further provided with a second passageway 34 with a restriction 36 therein.

The control valve 18 is switchable between an inlet position and an exhaust position. The inlet position permits air received from the inlet to pass first into the purge chamber 24 via the desiccant compartment 28 and thereafter to the service chamber 22 via the non-return valve 26. The exhaust position of the control valve 18 permits air in the purge chamber 24 to flow through the desiccant compartment 28 and out to atmosphere via a vent 38 in the control valve housing.

The control valve 18 is connected to a controller 40 which under normal operating conditions periodically moves the control valve 18 to the exhaust position to permit regeneration of the desiccant in the desiccant chamber 28 by the dry air in the purge chamber 24. The controller is sensitive to the condition of the compressor (not shown) so that regeneration will not take place when the compressor is on load. According to the present invention the controller 40 is also operable so as to move the control valve 18 to the exhaust position when use of the vehicle ceases. For example, the controller may be sensitive to the vehicle's ignition system such that when the ignition system is switched off the control valve moves to the exhanst position and the desiccant is regenerated. The control valve 18 then reverts to the inlet position ready to receive air from the compressor when the vehicle is reactivated.